***CSE 5360 AI Assignment 6***

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**Answer 1.**

Check\_equivalence(KB1,KB2){

Return Check\_implies(KB1,KB2) && Check\_implies(KB2,KB1);

}

Check\_implies(KB1,KB2){

Return OR(NOT(KB1),KB2);

}

NOT(KB){

Return !KB;

}

OR(KB1,KB2){

Return KB1 || KB2;

}

**Answer 2.**

(A). Yes, because if KB is true at any state, S1 is true too

If KB is false at any state, either S1 is true or false which satisfies the conditions for entailment.   
Hence, KB |=S1.

(B). No, if KB is true at any any state and S1 is false, this doesn’t satisfy the conditions for the entailment and hence by truth table for inference, KB|≠S1.

**Answer 3.**

CNF Form = (¬A∨B∨¬C∨D)∧( ¬A∨¬B∨¬C∨¬D)  
  
Solution Below in TABLE.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **A** | **B** | **C** | **D** | **KB** |
| F | F | F | F | T |
| F | F | F | T | T |
| F | F | T | F | T |
| F | F | T | T | T |
| F | T | F | F | T |
| F | T | F | T | T |
| F | T | T | F | T |
| F | T | T | T | T |
| T | F | F | F | T |
| T | F | F | T | T |
| T | F | T | F | F |
| T | F | T | T | T |
| T | T | F | F | T |
| T | T | F | T | T |
| T | T | T | F | T |
| T | T | T | T | F |

As per rules, we know how to calculate CNF.

CNF(KB) = ¬(ROW 10) ∧ ¬ (ROW 15)

= ¬(A ∧ ¬B ∧ C ∧ ¬D) ∨ ¬ (A∧B∧C∧D)

= (¬A ∨ B ∨ ¬C ∨ D) ∧ (¬A ∨ ¬B ∨ ¬C ∨ ¬D)

**Answer 4.**

A: It rains on May 1, 2017

B: John Gives Mary a check for $10,000 on May 2, 2017.

C: Mary mows the lawn on May 3, 2017

Part a: (A**→**B)∧(B**→**C)

Part b: What Truly happened:

¬A: it did not rain

B: John gave Mary a $10,000

C: Mary mowed the lawn

Part c: Contract was not violated as you can see below.

¬A∧B∧C: F, T, T;

Contract: T  
Hence, Contract not violated.

**Truth Table:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** | **B** | **C** | **(A→B)** | **(B→C)** | **Contract: (A→B)∧(B→C)** |
| F | F | F | T | T | T |
| F | F | T | T | T | T |
| F | T | F | T | F | F |
| **F** | **T** | **T** | **T** | **T** | **T** |
| T | F | F | F | T | F |
| T | F | T | F | T | F |
| T | T | F | T | F | F |
| T | T | T | T | T | T |

**Answer 5.**

1. **∃**x Dog(x) ∧ Name (x, shadow)
2. Gives (John, Mary, Shadow)
3. Male(Shadow)→Gives (Mary, John, x) ∧ Smartphone(x)
4. Female(Shadow)→Gives (Mary, John, x) ∧ Laptop(x)
5. ∀x∀y Gives (John, x, y) ∧ Person(x)→Male(y)∧Dog(y)
6. Gives (Mary, John, x) ∧ Laptop(x)

* X and Y are variables and Shadow, John, Mary are constants.
* Male, Dog, Name, Gives, Female, Laptop, Smartphone and Person are all Boolean Predicates.
* Gives (x, y, z) means x gives y to z.
* Male(x) means x is a male.

**Answer 6.**

**1. Symbols:**

B(x): x is taller than Bill. FOL: (taller (x, Bill))

C(x): x is tall. FOL: (tall(x))

B(John): John is taller than Bill. FOL: (taller (John, Bill))

**2. Propositional Logic KB:**

B(John)

∀x B(x)→C(x)